Medical Parasitology

Introduction

Medical parasitology deals with the parasites that cause human infections and the diseases they produce.

Parasites

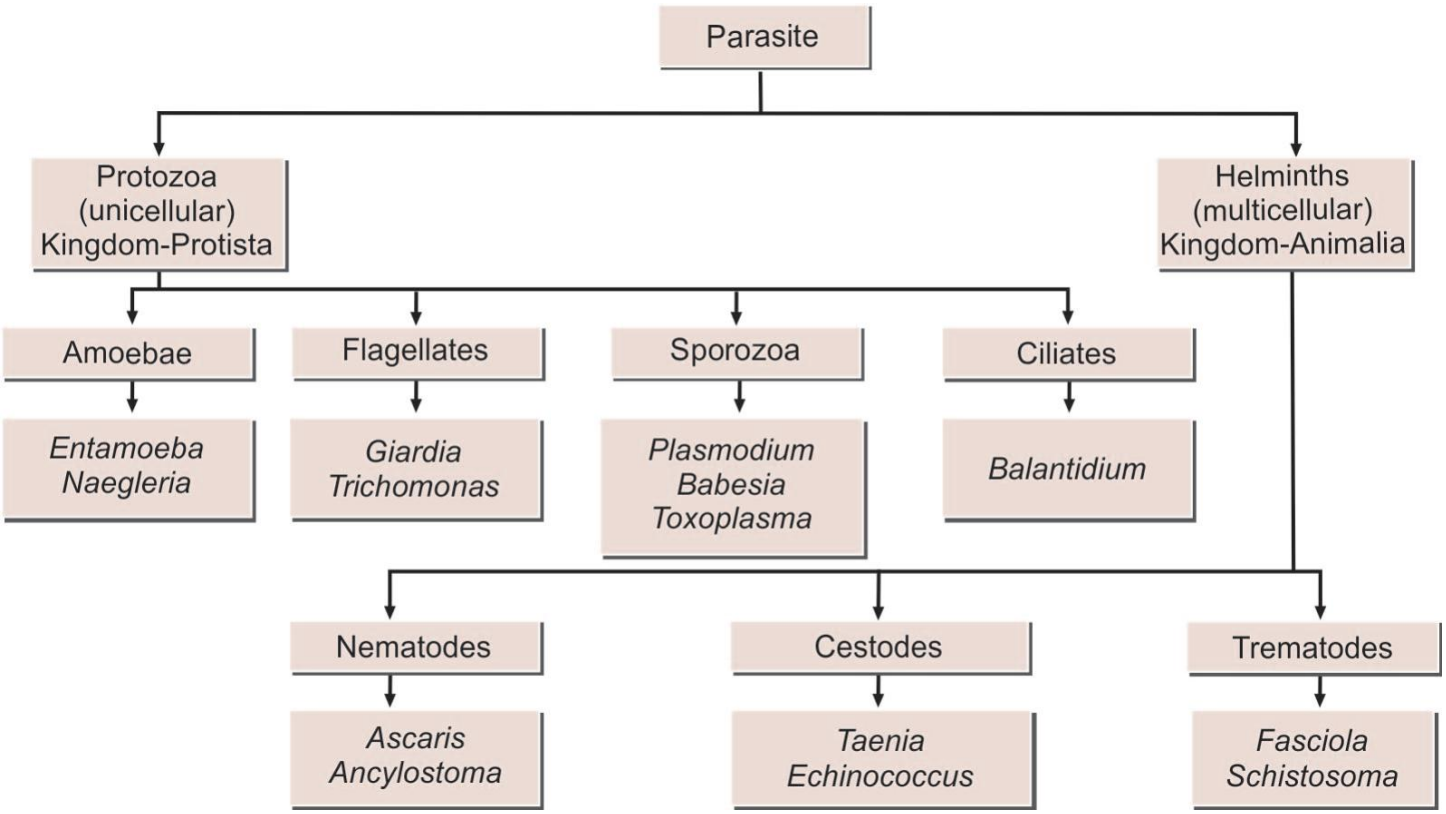
Parasites are living organisms that depend on a living host for their **nourishment and survival**. They multiply or undergo development in the host.

The term 'parasite' is usually applied **to Protozoa (unicellular organisms)** and **Helminths (multicellular organisms).**

Host: an organism that harbors a parasite.

The parasites of medical importance fall into the kingdom:

- Protista and
- animalia.



Type of parasites

Parasites can also be classified as:

- ✓ **Ectoparasite:** Ectoparasites **inhabit only the body surface** of the host without penetrating the tissue. **Lice**, **ticks**, and **mites are examples** of ectoparasites.
- ✓ **Endoparasite**: A parasite, which lives within the body of the host and is said to cause an infection is called an **endoparasite**. Most of the **protozoan** and **helminthic parasites** causing **human disease** are endoparasites.
- ✓ **Free-living parasite:** It refers to nonparasitic stages of active existence, which live independent of the host, e.g. cystic stage of Naegleria floweri.

Endoparasites can further be classified as:

1. **Obligate parasite:** The parasite, which cannot **exist without a host**, e.g. **Toxoplasma gondii and Plasmodium.**
2. **Facultative parasite:** An organism that may live **either as a parasitic form** or as a **free-living form**.
3. **Accidental parasites:** Parasites, which infect an **unusual host**, are known as **accidental parasites**. **Echinococcus granulosus** infects humans accidentally, causing **hydatid cysts**.
4. **Aberrant parasites:** Parasites, which **infect a host** where they cannot develop **further,** are known as **aberrant or wandering parasites**.

Host:

A host is defined as an organism that harbors the parasite and provides nourishment and shelter to the parasite, and is relatively **larger than the parasite**.

The host may be of the following types:

- ✓ **Definitive host:** The host, in which the **adult parasite lives and undergoes** sexual reproduction, is called the definitive host, e.g., a mosquito acts as the **definitive** host in malaria.
- ✓ **Intermediate host:** The host, in which the larval stage of the parasite lives or **asexual multiplication** takes place, is called the **intermediate host**.
- ✓ **Reservoir host:** In an **endemic area**, a parasitic infection is **continuously maintained** by the presence of a **host, which harbors the parasite** and acts as an important source of infection to other **susceptible hosts**
- ✓ **Accidental host:** The host, in which the parasite is not usually found, e.g. man is an accidental host for **cystic echinococcosis**.

Zoonosis

- The term zoonosis was introduced by Rudolf Virchow in 1880 to refer to **diseases shared by humans and animals in nature**.
- Later, in 1959, the World Health Organization (WHO) defined zoonosis as "those diseases and infections, which are naturally transmitted between vertebrate animals and man".

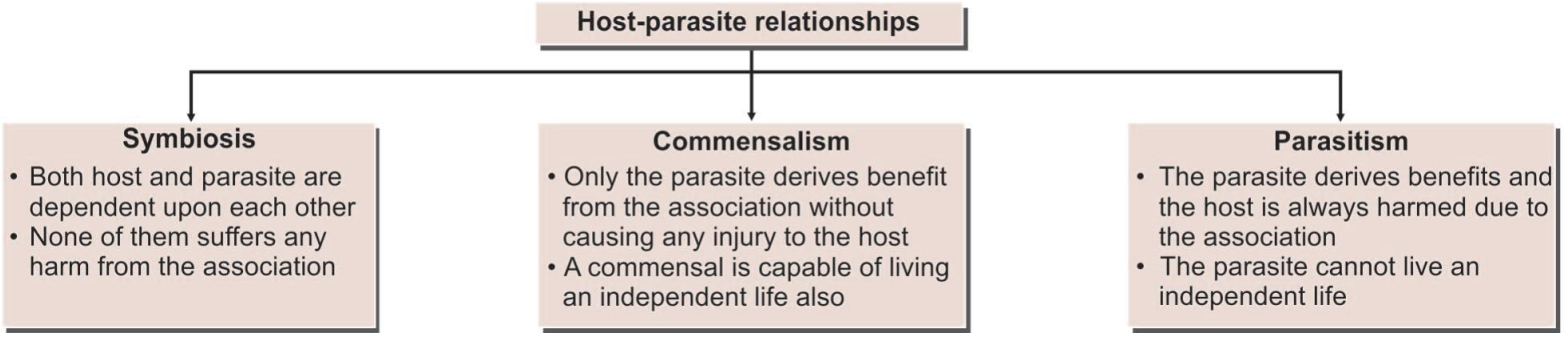
It is of the following types:

- Protozoal zoonoses, e.g., toxoplasmosis, leishmaniasis, balantidiasis.
- Helminthic zoonoses, e.g., hydatid disease.

Host-parasite Relationships

Host-parasite relationships are of the following types

- ✓ Symbiosis
- ✓ Commensalism
- ✓ Parasitism.



Host-parasite relationships

Life Cycle of Parasites

a. Direct life cycle: When a parasite requires **only a single host** to complete its development, it is called a direct life cycle, e.g., **Entamoeba histolytica requires only a human host to complete its life cycle**.
b. Indirect life cycle: When a parasite **requires 2 or more host species** to complete its development, the life cycle is called indirect, e.g., the malarial parasite requires both the human host and the mosquito to complete its life cycle.

Sources of Infection

- ✓ **Contaminated soil and water:**

- Soil polluted with **embryonated eggs** (roundworm, whipworm may be ingested, **or infected larvae in soil may penetrate exposed skin (hookworm**)
- Infective forms of parasites present in water may be ingested (cysts of **amoeba and Giardia**)
- Infected larvae in water may enter by penetrating exposed skin **(cercariae of schistosomes**)
- Free-living parasites in water may directly enter through vulnerable sites (Naegleria may enter through the nasopharynx).

✓ **Food:**

- Ingestion of contaminated food or vegetables containing the infective stage of the parasite (amoebic cysts, Toxoplasma oocysts, Echinococcus eggs)
- Ingestion of raw or under-cooked meat harboring infective larvae (measly pork containing cysticercus cellulosae, the larval stage of Taenia solium).

✓ **Insect vectors:**

A vector is an agent, usually an arthropod, that transmits an infection from person to person or from other animals to humans; for example, female Anopheles is the vector of the malaria parasite. Vectors can be:

- Biological vectors: The term biological vector refers to a vector that not only assists in the transfer of parasites but also allows the parasites to undergo development or multiplication in their body. They are also called true vectors.
  - ❑ Mosquito—Malaria, filariasis
  - ❑ Sandflies—Kala-azar
- Mechanical vectors: The term mechanical vector refers to a vector that assists in the transfer of parasitic form between hosts but is not essential in the life cycle of the parasite. An example of Mechanical vectors is:
  - ˆ Housefly—amoebiasis

✓ **Animals:**

Domestic:

- Cow, e.g., T. saginata, Sarcocystis
- Pig, e.g. T. solium, Trichinella spiralis
- Dog, e.g. Echinococcus granulosus
- Cat, e.g., Toxoplasma, Opisthorchis.

Wild:

- Wild game animals, e.g., trypanosomiasis
- Fish, e.g., fish tapeworm

Modes of Infection

- **Oral transmission:** The most common route is through contaminated food, water, soiled fingers, or fomites.
- **Skin transmission:** Entry through skin is another important mode of transmission.
- **Vector transmission:** Many parasitic diseases are transmitted by insect bite, e.g., malaria is transmitted by the bite of a female Anopheles mosquito. A vector can be biological or mechanical.
- **Direct transmission:** Parasitic infection may be transmitted by person-to-person contact in some cases, e.g., by kissing in the case of gingival amoebae and by sexual intercourse in trichomoniasis.
- **Vertical transmission:** Mother-to-fetus transmission may take place in malaria and toxoplasmosis.
- **Iatrogenic transmission:** It is seen in cases of transfusion malaria and toxoplasmosis after organ transplantation.

Laboratory Diagnosis

Most of the parasitic infections cannot be conclusively diagnosed. On the basis of clinical features and physical examination, laboratory diagnosis depends upon:

a. Microscopy
b. Culture
c. Serological test
d. Skin test
e. Molecular method
f. Animal inoculation
g. Xenodiagnosis
h. Imaging
i. Hematology.